1. A method of determining the wall thickness of a tubular workpiece and the speed of sound within said tubular workpiece from a single set of recorded ultrasound data, said method comprising the steps of:

configuring an acoustic couplant medium;

placing at least one ultrasonic transducer in acoustic communication with said couplant medium;

defining a transmission path in said acoustic couplant medium;

selectively disposing said tubular workpiece in said acoustic couplant medium such that said tubular workpiece is in said transmission path;

defining, along said transmission path, an acoustic discontinuity at each interface between a surface of said tubular workpiece and said acoustic couplant medium;

transmitting a plurality of ultrasound waves through said transmission path, at least one of said plurality of ultrasound waves being transmitted without the presence of said tubular workpiece in said transmission path;

receiving signals corresponding to:

said plurality of transmitted ultrasound waves that are reflected from at least one of said acoustic discontinuities; and

said plurality of transmitted ultrasound waves that traverse the substantial entirety of said transmission path;

recording time and amplitude data for each of said received signals;

calculating a speed of sound in said tubular workpiece based on said recorded time and amplitude data; and

calculating a thickness of each wall of said tubular workpiece based on said recorded time and amplitude data.

2. A method according to claim 1, comprising the additional step of determining a speed of sound in said acoustic couplant medium.

3. A method according to claim 2, wherein said step of determining a speed of sound in said tubular workpiece is performed to the exclusion of a predetermined speed of sound quantity in said tubular workpiece.

4. A method according to claim 1, wherein said recorded data is configured to effect a time-domain analysis based on the time delays of arrival of at least a portion of said ultrasound waves.

5. A method according to claim 4, wherein said thickness of a first of said walls is calculated using the equation $L_1 = \frac{c\Delta t_1}{2}$ and said thickness of a second of said walls is calculated using the equation $L_2 = \frac{c\Delta t_2}{2}$, where said speed of sound c is calculated using the equation $c = c_w\left[\frac{2\Delta t_3}{\Delta t_1 + \Delta t_2} + 1\right]$, where c_w represents a predetermined value for the speed of sound of said ultrasound waves in said acoustic couplant medium, and said recorded ultrasound data is used to determine Δt_1, Δt_2 and Δt_3, which represent time of arrival differences associated with ultrasound waves reflected from the outer and inner surfaces of said first wall, reflected from the outer and inner surfaces of said second wall, and time of arrival differences associated with ultrasound waves transmitted through said transmission path both with and without the presence of said workpiece in said acoustic couplant medium, respectively.

6. A method according to claim 1, wherein said recorded data is configured to effect a frequency-domain analysis based on the phase differences of at least a portion of said ultrasound waves.

7. A method according to claim 6, wherein said thickness of a first of said walls is calculated using the equation $L_1 = \frac{\Delta\theta_1}{4\pi f} V_p(f)$ and said thickness of a second of said walls is calculated using the equation $L_2 = \frac{\Delta\theta_2}{4\pi f} V_p(f)$, where said speed of sound is represented by a phase velocity as a function of frequency $V_p(f)$, and is calculated using the equation

$V_p(f) = c_w\left[\frac{2\Delta\theta_3(f)}{\Delta\theta_1(f)+\Delta\theta_2(f)}+1\right]$, where c_w represents a predetermined value for the speed of sound of said ultrasound waves in said acoustic couplant medium, and said recorded ultrasound data is used to determine $\Delta\theta_1$(f), $\Delta\theta_2$(f) and $\Delta\theta_3$(f), which represent phase spectra differences at each frequency associated with ultrasound waves reflected from the outer and inner surfaces of said first wall, reflected from the outer and inner surfaces of said second wall, and phase spectra differences associated with ultrasound waves transmitted through said transmission path both with and without the presence of said workpiece in said acoustic couplant medium, respectively.

8. A method according to claim 1, wherein said tubular workpiece is disposed in said transmission path such that during the step of transmitting a plurality of ultrasound waves, said waves impinge substantially orthogonal to the outer and inner surfaces of said tubular workpiece.

9. A system for determining the wall thickness of an object and the speed of sound within said object from a single set of recorded ultrasound data, said system comprising:

an acoustic couplant medium with a transmission path defined therein, said acoustic couplant medium configured to selectively receive a tubular workpiece disposed in said transmission path such that each interface between a surface of said tubular workpiece and said acoustic couplant medium defines an acoustic discontinuity;

at least one ultrasonic transducer cooperative with said acoustic couplant medium, said transducer configured to transmit and receive signals, said received signals corresponding to time and amplitude data of ultrasound waves reflected from said acoustic discontinuities and transmitted ultrasound waves that traverse the substantial entirety of said transmission path;

signal receiving and recording apparatus operatively coupled to said transducer, said signal receiving and recording apparatus configured to:

calculate the speed of sound within said tubular workpiece based on said received signals; and

calculate the thickness of each wall of said tubular workpiece based on said received signals.

10. A system according to claim 9, wherein said signal processing apparatus is configured to effect a time-domain analysis based on time delays of arrival of at least a portion of said ultrasound waves.

11. A system according to claim 9, wherein said signal processing apparatus is configured to effect a frequency-domain analysis based on spectral content of at least a portion of said ultrasound waves.

12. A system according to claim 9, wherein said at least one ultrasonic transducer comprises a plurality of ultrasonic transducers.

13. A method of determining the wall thickness of and speed of sound within a tubular workpiece, said method comprising the steps of:

configuring an acoustic couplant medium;

placing at least one ultrasonic transducer in acoustic communication with said couplant medium;

transmitting an ultrasound wave through said acoustic couplant medium;

receiving said transmitted ultrasound wave;

recording data corresponding to said transmitted ultrasound wave;

placing said tubular workpiece in said acoustic couplant medium;

generating ultrasound waves within said acoustic couplant medium such that at least a portion of said waves are reflected back from at least one surface of said tubular workpiece while another portion of said waves are transmitted through said couplant medium and said tubular workpiece;

receiving signals reflected from at least one surface of said tubular workpiece; and

receiving signals transmitted through said couplant medium and said tubular workpiece;

recording data corresponding to said signals;

calculating a speed of sound in said tubular workpiece based on said recorded data; and

calculating a thickness of each wall of said tubular workpiece based on said recorded data.

14. A method according to claim 13, comprising the additional step of extracting the spectral content of said detected signals from said recorded data to effect a frequency-domain analysis.

15. A method according to claim 13, wherein said step of placing at least one ultrasonic transducer in acoustic communication comprises placing a plurality of transducers in communication with said acoustic couplant medium, and said step of placing said tubular workpiece in said acoustic couplant medium comprises placing said workpiece between said plurality of ultrasonic transducers.

16. A method of determining the wall thickness of and speed of sound within a hollow workpiece, said method comprising the steps of:

configuring an acoustic couplant medium;

placing at least one ultrasonic transducer in acoustic communication with said couplant medium;

defining a transmission path in said acoustic couplant medium;

selectively disposing said hollow workpiece in said acoustic couplant medium such that said hollow workpiece is in said transmission path;

defining, along said transmission path, an acoustic discontinuity at each interface between a surface of said hollow workpiece and said acoustic couplant medium;

transmitting a plurality of ultrasound waves through said transmission path, at least one of said plurality of ultrasound waves being transmitted without the presence of said hollow workpiece in said transmission path;

receiving signals corresponding to:

said plurality of transmitted ultrasound waves that are reflected from at least one acoustic discontinuity; and

said plurality of transmitted ultrasound waves that traverse the substantial entirety of said transmission path;

recording data for each of said received signals;

calculating a speed of sound in said hollow workpiece based on said recorded data; and

calculating a thickness of each wall of said hollow workpiece based on said recorded data.

17. A method according to claim 16, comprising the additional step of extracting, based on said recorded data, the spectral content of each of said received signals to effect a frequency-domain analysis.

18. A method of determining the wall thickness of a tubular workpiece and the speed of sound within said tubular workpiece, said method comprising the steps of:

configuring an acoustic couplant medium;

placing at least one ultrasonic transducer within said couplant medium;

defining a transmission path in said acoustic couplant medium;

transmitting a first ultrasound pulse along said transmission path when said tubular workpiece is disposed therein such that at least a portion of said first ultrasound pulse echoes off at least one surface of said tubular workpiece;

transmitting a second ultrasound pulse along said transmission path in a substantially opposite direction relative to said first pulse when said tubular workpiece is disposed therein such that at least a portion of said second ultrasound pulse echoes off at least one surface of said tubular workpiece;

transmitting a third ultrasound pulse along said transmission path when said tubular workpiece is disposed therein such that at least a portion of said third ultrasound pulse passes through the substantial entirety of both said tubular workpiece and said acoustic couplant medium;

transmitting a fourth ultrasound pulse along said transmission path when said tubular workpiece is not disposed therein such that at least a portion of said fourth

ultrasound pulse passes diametrically through the substantial entirety of said acoustic couplant medium;

detecting echo signals corresponding to said transmitted first and second ultrasound pulses, and signals corresponding to said transmitted third and fourth ultrasound pulses;

recording time and amplitude data for said detected signals;

calculating a speed of sound in said tubular workpiece based on said recorded time and amplitude data; and

calculating a thickness of each wall of said tubular workpiece based on said recorded time and amplitude data.

19. A method according to claim 18, wherein said first ultrasound pulse is generated by a first transmitting device, and said second ultrasound pulse is generated by a second transmitting device.

20. A method according to claim 19, wherein said first and second transmitting devices are configured to transmit their respective ultrasound pulses in opposite directions along a substantially common line.

21. A method according to claim 19, wherein said first and second transmitting devices are configured to both transmit their respective ultrasound pulses and receive the corresponding echoes reflected from the interfaces between the workpiece and acoustic couplant medium.

22. A method according to claim 19, wherein said third and fourth ultrasound pulses can be generated by either of said first and second transmitting devices and subsequently received by the other of said first and second transmitting devices.

23. A method of determining the wall thickness of a tube and speed of sound within said tube, said method comprising the steps of:

selectively disposing said tube in an acoustic couplant medium;

placing at least one ultrasonic transducer within said couplant medium;

defining a transmission path in said acoustic couplant medium;

defining, along said transmission path, an acoustic discontinuity at each interface between a surface of said tube and said acoustic couplant medium;

generating a plurality of ultrasound waves at least one of which is generated without the presence of said tube in said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that reflects off the first of said acoustic discontinuities encountered along said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that reflects off the second of said acoustic discontinuities encountered along said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that reflects off the third of said acoustic discontinuities encountered along said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that reflects off the fourth of said acoustic discontinuities encountered along said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that passes through said tubular member and across the substantial entirety of said transmission path;

recording data corresponding to the portion of said plurality of ultrasound waves that passes across the substantial entirety of said transmission path when said tubular member is not disposed therein;

calculating a speed of sound in said tube based on said recorded data; and

calculating a thickness of each wall of said tube based on said recorded data.